

1 **SELF-CONTAINED ILLUMINATION DEVICE FOR MEDICINE CONTAINERS**

2

3 **CROSS REFERENCES TO RELATED APPLICATIONS**

4 Not applicable.

5

6 **BACKGROUND — FIELD OF INVENTION**

7 The present invention relates to a self-contained
8 illumination device for containers and more particularly
9 pertains to permitting illumination of difficult-to-read
10 medication labels in low-light environments with an
11 illumination device for medicine containers.

12

13 **BACKGROUND — STATE OF THE ART**

14 There are many occasions when an individual must wake from
15 sleep, arise and take medications during the nighttime hours,
16 when light levels are low. Medications, such as pain medicine,
17 sleeping pills, antacids, migraine medicine, and medication
18 that must be taken on timed schedules (e.g., four times per
19 24-hour period), among others, are often taken in the
20 nighttime hours. Often, the individual requiring the
21 medication has been asleep and thus is groggy and sometimes
22 disoriented. The medication is generally contained in a
23 medicine cabinet and/or a drawer in the bathroom, or in a

1 drawer near the individual's bed, along with many other
2 medications (which are increasing every year as many new drugs
3 become available, and as the population of the elderly
4 increases). When combined, the above conditions, e.g., low
5 light and/or no light, multiple medications in one location,
6 pain and sleepiness, can increase the chances that the
7 individual will take the wrong medicine or dosage.

8

9 One method for decreasing the chance of taking the wrong
10 medicine is to provide light so that the individual can
11 accurately read the medicine container label. The most often
12 used method for achieving this is by turning on a light within
13 the room (e.g., an overhead light in the bathroom or a desk
14 lamp near the bed). This method has the disadvantage of
15 causing further pain and disorientation, as the individual's
16 pupils are most likely dilated due to the low-light level
17 conditions and the sleep state. This method also has the
18 undesirable affect of disrupting the sleep pattern of the
19 individual, by bringing him closer to the state of awakeness,
20 thus possibly further complicating the condition requiring the
21 medication. Another less-used method for providing light is
22 to use some type of hand-held light, such as a flashlight or
23 book-reading light, to illuminate the medicine container. Due

1 to the direct, bright light of these devices, this method has
2 similar problems as turning on a light, as discussed above.
3 Additionally, this method is more difficult for the sleepy,
4 groggy individual, as it requires two hands to examine the
5 medicine container label and to open the container and
6 retrieve the medicine. Further, flashlights and book-reading
7 lights are often misplaced, have run-down batteries, and may
8 not be in the correct location when needed. Finally, a
9 nightlight may be used, but often these are not even
10 available, or are situated away from the medicine container
11 location (e.g., usually in an electrical outlet near the floor
12 and/or near the toilet) and thus the patient must carry many
13 medicine containers to the nightlight in order to retrieve the
14 correct medicine. Again, this method is more difficult for the
15 sleepy, groggy individual and offers the further danger of the
16 individual falling and/or colliding with something in the
17 pathway to the nightlight.

18

19 While these methods fulfill the objective of aiding the
20 individual in retrieving the correct medication, it is obvious
21 that they can exacerbate the original problem that caused the
22 need for medication, or even cause further problems.

23

1 Therefore, from the above, it can be appreciated that
2 there is a pressing and increasing need for a means to provide
3 better illumination of medicine containers.

4

5 **SUMMARY OF THE INVENTION**

6 The present invention is directed to improved containers
7 for medicines, and in particular to improved illumination of
8 medicine container labels to aid the individual in retrieving
9 the correct medication in low-light level environments.

10

11 **Objects and Advantages**

12 It is therefore an object of the invention to provide an
13 illumination device for medicine containers, which prevents
14 the possibility of an individual taking the wrong medication
15 due to low-level lighting conditions.

16

17 It is another object of the invention to provide an
18 illumination device for medicine containers, which illuminates
19 the medicine container label in such a way, that the
20 individual's eyes receive a minimum amount of direct light.

21

22 It is a further object of the invention to provide an
23 illumination device for medicine containers, which illuminates

1 the medicine container label with a wavelength (color) and
2 level of light intensity that does not cause the individual
3 discomfort due to dilated pupils.

4

5 It is also an object of the invention to provide an
6 illumination device for medicine containers, which may be
7 easily and efficiently manufactured and marketed.

8

9 It is an additional object of the invention to provide an
10 illumination device for medicine containers, which is of
11 durable and reliable construction.

12

13 It is yet another object of the invention to provide an
14 illumination device for medicine containers, which is
15 waterproof.

16

17 It is yet a further object of the invention to provide an
18 illumination device for medicine containers, which couples to
19 a wide variety of types of medicine containers and/or medicine
20 container caps used in the medical area.

21

22 It is yet an additional object of the invention to provide
23 an illumination device for medicine containers, which is

1 adapted to a low cost of manufacture with regard to both
2 materials and labor, thereby making the invention disposable
3 or reusable, and which accordingly is then adapted for sale at
4 low prices to the consuming public, thereby making such an
5 illumination device for medicine containers economically
6 available to the buying public.

7

8 In accord with these objects, which will be discussed in
9 detail below, a self-contained illumination device for
10 medicine containers is provided. The illumination device
11 includes a light source component for illumination, a switch
12 component to control the light source, supporting circuitry
13 components to energize the light source, and a housing
14 structure for: supporting and enclosing the components;
15 directing the illumination to the label; and coupling the
16 illumination device to a medicine container and/or a
17 conventional medicine container cap. In a preferred
18 embodiment, a light emitting diode (LED), emitting a bluish
19 color, provides the illumination. An electrical switch is
20 provided to connect an energy source to the LED thus turning
21 it "ON." The light generated by the energized LED is further
22 directed through a circular light-pipe channel within the
23 device, which then directs it toward the label, thereby

1 illuminating the label in a 360-degree field. Supporting
2 circuitry includes a battery with an electrical current-
3 limiting potentiometer mounted on a printed circuit board
4 (PCB). The housing structure is a molded plastic material
5 containing a flexible material positioned directly over the
6 switch, which allows the individual to activate the switch
7 while also providing protection of internal components from
8 the outside environment, e.g., a waterproof seal.
9 Additionally, the housing structure provides the light-pipe
10 channel; encapsulates the above components; and is designed to
11 couple to a medicine container receptacle and/or a
12 conventional medicine container cap.

13

14 The resultant self-contained illumination device for
15 medicine containers is adapted for excellent illumination of
16 medicine container labels in low-light level environments. An
17 illumination device for medicine containers has application in
18 the medical arts in the home environment for both humans and
19 pets, unfamiliar locations (e.g., hotel rooms while traveling,
20 camping, etc.), the clinical environment (hospitals and long-
21 term care facilities), and in the pharmaceutical environment
22 (pharmacies and/or pharmaceutical production laboratories); in
23 the use of chemical handling in low-light level conditions,

1 such as in chemical laboratories and/or photography
2 laboratories; and in the general home environment, for
3 example, with spice containers, jars or household cleaners, in
4 non-lighted cabinets or at night; among other fields.

5

6 There has been outlined, rather broadly, features of the
7 invention in order that the detailed description thereof that
8 follows may be better understood, and in order that the
9 present contribution to the art may be better appreciated.

10 There are, of course, additional features of the invention
11 that will be described hereinafter and which will form the
12 subject matter of the claims appended hereto.

13

14 In this respect, before explaining at least one embodiment
15 of the invention in detail, it is to be understood that the
16 invention is not limited in its application to the details of
17 construction and to the arrangements of the components set
18 forth in the following description or illustrated in the
19 drawings. The invention is capable of other embodiments and
20 of being practiced and carried out in various ways. Also, it
21 is to be understood that the phraseology and terminology
22 employed herein are for the purpose of description and should

1 not be regarded as limiting.

2

3 **BRIEF DESCRIPTION OF THE DRAWINGS**

4

5 Fig. 1 is a perspective view of the preferred embodiment of
6 a medicine container with a container cap that illuminates a
7 container label with light in a continuous 360-degree range;

8

9 Fig. 2 is a cross-sectional profile through the medicine
10 container and container cap, taken on line 1-1 in Fig. 1,
11 describing a side view of the functional components contained
12 within the container cap;

13

14 Fig. 3 is a perspective view of a container cap insert
15 cover, which retains a flexible membrane;

16

17 Fig. 4 is a circuit schematic of the preferred embodiment;

18

19 Fig. 5 is a cross-sectional profile of the flexible
20 membrane.

21

22 Fig. 6 is a perspective view of a cylindrical adaptor used
23 to connect the flexible membrane to an electrical switch.

1

2 Fig. 7 is a top plan view of the container cap of Fig. 1
3 showing the flexible membrane material and the container cap
4 insert cover;

5

6 Fig. 8 is a top view of the functional components contained
7 within the container cap of Fig. 2 with the container cap
8 insert cover removed;

9

10 Fig. 9 is a bottom plan view of the container cap of Fig. 1
11 showing an annular output opening and functional components
12 contained within the container cap;

13

14 Fig. 10 is a perspective view of a second embodiment of a
15 medicine container with a container cap that illuminates the
16 container label with visible light in a continuous 360-degree
17 range using multiple LEDs;

18

19 Fig. 11 is a cross-sectional profile through the medicine
20 container and container cap, taken on line 3-3 in Fig. 10,
21 describing a side view of the functional components contained
22 within the container cap;

23

1 Fig. 12 is a top plan view of the container cap of Fig. 10
2 showing the flexible membrane material and the container cap
3 insert cover;

4
5 Fig. 13 is a top view of the functional components contained
6 within the container cap of Figure 10 with the container cap
7 insert cover removed;

8
9 Fig. 14 is a bottom plan view of the container cap of Fig.
10 10 showing four LEDs used for illumination;

11
12 Fig. 15 is a circuit schematic of the second embodiment;

13
14 Fig. 16 is a perspective view of a third embodiment of a
15 medicine container with a container cap describing a flexible
16 membrane material covering a side-mounted switch;

17
18 Fig. 17 is a perspective view of a fourth embodiment of a
19 medicine container with a container cap describing a flexible
20 container cap insert cover;

21.

1 Fig. 18 is a block diagram of a fifth embodiment describing
2 an additional circuit to control the LEDs used for
3 illumination;

4

5 Fig. 19 is a block diagram of a sixth embodiment describing
6 another circuit to control the LEDs used for illumination;

7

8 Fig. 20 is a block diagram of a seventh embodiment
9 describing the combination of the circuitry shown in Figs. 18
10 and 19 used to control the LEDs used for illumination;

11

12 Fig. 21 is a side elevation view of an eighth embodiment of
13 a medicine container with a container cap that is removably
14 coupled to a conventional container cap and medicine container
15 therewith;

16

17 Fig. 22 is an exploded, side elevation view of the
18 embodiment shown in Fig. 21 describing the physical
19 relationship between the container cap and the conventional
20 container cap, and medicine container therewith, in the
21 decoupled state;

22

1 Fig. 23 is a perspective view of a ninth embodiment of a
2 medicine container with a container illumination base that is
3 removably coupled to the medicine container therewith;

4

5 Fig. 24A is a top plan view of the container illumination
6 base shown in Fig. 23;

7

8 Fig. 24B is a cross-sectional profile through the medicine
9 container and container illumination base, taken on line 5-5
10 in Fig. 24A;

11

12 Fig. 25 is a perspective view of a tenth embodiment of a
13 medicine container with an enclosing container illumination
14 lightpipe that is removably coupled to the medicine container
15 therewith; and

16

17 Fig. 26 is a cross-sectional profile through the medicine
18 container and enclosing container illumination lightpipe,
19 taken on line 7-7 in Fig. 25, describing a side view of the
20 light source beam paths.

21

22

23

1 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

2

3 With reference now to the drawings, FIGS. 1 through 9
4 illustrate a medicine container, generally 20, embodying a
5 container cap, generally 22, and a container label 32 attached
6 to a container receptacle 28 of the present invention.

7 Container receptacle 28 includes a wall 25 with an outer
8 surface 26. Label 32 attaches to outer surface 26 and includes
9 a set of instructional text 34, or other indicia, which lists
10 information about the patient and a medicinal product 30
11 contained in the container receptacle 28, including product
12 name, dosage instructions, expiration date, refill
13 information, and/or other medicinal product information. This
14 set of instructional text 34, and identification of the
15 medicinal product 30, is the critical information the patient
16 must read and recognize, respectively, in the low-light level
17 environment. Additionally, label 32 may also be in the form of
18 a small, peel-back instructional booklet, usually with very
19 small print, which contains additional information regarding
20 the medicinal product 30. Other types of container labels 32
21 may exist as well and be illuminated by a plurality of light
22 beams, generally 36.

23

1 Container cap **22** is comprised of an inner annular support
2 structure **74** having a central opening **75** into which is placed
3 a printed circuit board **60**. Thus, printed circuit board **60** is
4 contained within container cap **22** and is preferably positioned
5 perpendicular to the longitudinal axis of the attached
6 container receptacle **28**. Printed circuit board **60** is secured
7 in central opening **75** to inner annular support structure **74**
8 preferably by an adhesive **61**, such as AS-124M removable
9 adhesive, available from Adhesives Research, Inc., although
10 other securing methods may be used (e.g., bonding agents or
11 mechanical fasteners). An outer annular support rim **70**
12 contains an aperture ledge **71**, which accepts a container cap
13 insert cover **24**. Container cap insert cover **24** is connected to
14 outer annular support rim **70** at aperture ledge **71** by a
15 frictional fit or by an adhesive, e.g., silicone rubber or AS-
16 124M removable adhesive, available from Adhesives Research,
17 Inc. Outer annular support rim **70** fits onto inner annular
18 support structure **74** at an annular snap junction **82** to form a
19 physical connection between the two (or outer annular support
20 rim **70** can be attached to inner annular support structure **74**
21 by an adhesive, such as silicone rubber). A plurality of anti-
22 rotation pins **78** engage a plurality of anti-rotation pin

1 apertures 79, located in outer annular support rim 70, to keep
2 outer annular support rim 70 from rotating as container cap 22
3 is tightened or removed. Inner annular support structure 74 is
4 preferably fabricated by molding a clear or transparent
5 plastic material, such as Acrylic or Lexan. Outer annular
6 support rim 70 is preferably fabricated by molding an opaque
7 plastic material, such as colored Acrylic or colored Lexan, or
8 a moldable rubber material which provides additional gripping
9 friction, such as GE Silicones liquid injection moldable
10 rubber, LSR2005 elastomer. Additionally, inner annular support
11 structure 74 and outer annular support rim 70 can be machined
12 from plastic stock (e.g., cast Acrylic rod).

13

14 As seen in FIG. 3, container cap insert cover 24 is formed
15 with an insert aperture 42 which accepts a flexible membrane
16 46, preferably constructed from some type of rubber, e.g.,
17 silicone rubber, although any flexible material may be used.
18 As seen in FIG. 5, flexible membrane 46 has a circumferential
19 groove 54 with a tapered neck 38 just below groove 54. When
20 the flexible membrane 46 is inserted into container cap insert
21 cover 24 with the tapered neck 38 projecting downwardly
22 through insert aperture 42, circumferential groove 54 engages
23 insert aperture 42. Additionally, flexible membrane lip,

1 generally 44, seats against an insert ledge 50, which is
2 countersunk in container cap insert cover 24, thus forming a
3 smooth top surface for container cap 22, that is, flexible
4 membrane 46 does not protrude above container cap 22. Flexible
5 membrane 46 forms an environmentally protective barrier, e.g.,
6 waterproof, as well as making physical contact with an
7 electrical switch 52, e.g., a single-pole, single throw
8 Panasonic EVQ-PLDA15, through a cylindrical adaptor 80,
9 containing a top surface 86, which contacts flexible membrane
10 46, and a bottom surface 90, which contacts electrical switch
11 52 (FIG. 6). Cylindrical adaptor 80 is preferably manufactured
12 from a clear Acrylic plastic, although different colored
13 material may be used to change the final illumination color
14 (discussed in more detail below). Container cap 22 also
15 contains structure to produce a light pipe channel 72, which
16 is annular in shape in the preferred embodiment. The light
17 pipe channel 72 has a lightwave entry end 67 and a lightwave
18 exit end 68. A lightwave 76, generated by an illumination
19 source 40, e.g., a wide-angle, blue light emitting diode, such
20 as a Lumex SSL-LX3044USBD, enters lightwave entry end 67 in a
21 360-degree direction (see FIGS. 2 and 8). Optionally, other
22 LEDs, emitting other wavelengths (colors), or incandescent

1 bulbs, such as a Copeland retinoscope lamp bulb, may be used
2 to generate lightwave **76**. Once inside light pipe channel **72**,
3 lightwave **76** travels to lightwave exit end **68** and is emitted
4 in a 360-degree direction.

5

6 Additionally, the outer surface, generally **84**, of the
7 inner annular support structure **74** may be coated with a
8 reflective coating, such as gold, silver or aluminum, or with
9 multi-layer dielectric mirror coatings, to increase the
10 internal reflection of lightwave **76** toward lightwave exit end
11 **68**. Alternatively, the inner surface, generally **85**, of the
12 outer annular support rim **70** may be coated with a reflective
13 coating, such as gold, silver or aluminum, or with multi-layer
14 dielectric mirror coatings, to increase the internal
15 reflection of lightwave **76** toward lightwave exit end **68**.
16 Lightwave exit end **68** is formed at a slight angle, e.g.,
17 80-degrees from the longitudinal axis of attached container
18 receptacle **28**, thus directing the light beams **36** more directly
19 onto label **32**. Alternatively, lightwave exit end **68** can be
20 formed with no angle, e.g., 90-degrees to the longitudinal
21 axis of attached container receptacle **28**, while still
22 providing adequate illumination of label **32**.

1
2 Lightwave **76** emerges from lightwave exit end **68** through an
3 annular filter cover **62** to produce plurality of light beams
4 **36**, generally at annular output opening **63**. Annular filter
5 cover **62** may be clear, or may be manufactured with different
6 colors depending on the color of the LED used. For example,
7 annular filter cover **62** could be tinted, or constructed from a
8 blue-colored material, such as an optical thermocast plastic
9 color filter, available from Fosta-Tek Optics, or a Kodak
10 Wratten filter (e.g., a Kodak 38A), and when used with a white
11 LED, a blue illumination is produced at label **32**. There are a
12 wide variety of LED/filter combinations that can be used to
13 create many illumination colors. Annular filter cover **62** may
14 also be constructed to simultaneously diffuse lightwave **76**.
15 Additionally, as briefly discussed above, cylindrical adaptor
16 **80** may be machined, or thermocasted, from a colored plastic
17 material (available from Fosta-Tek Optics), and thus when used
18 with a white LED, various illumination colors may be
19 generated. Further, colored LED lens covers, e.g., a Chicago
20 Miniature Lamp 434-6, can be used, which snap directly onto
21 the LED itself, thus offering yet another method for achieving
22 various illumination colors. Thus, there are a number of
23 possibilities for creating various illumination colors.

1
2 Inner annular support structure **74** has a set of internal
3 threads **64** for attachment to a set of external threads **66** in
4 attached container receptacle **28**.

5
6 Printed circuit board **60** contains an energy source **56**,
7 e.g., a silver oxide button-cell, such as a Duracell D361,
8 which may be attached directly to printed circuit board **60**, or
9 may be inserted in an energy source holder **57**, e.g., a
10 Keystone model 500, thus making it replaceable, an electrical
11 current-limiting device **48**, e.g., a Bourns Series 3309P
12 potentiometer, the illumination source **40**, and the electrical
13 switch **52**, all connected by PCB circuit traces in order to
14 implement the closed circuit shown in FIG. 4. These circuit
15 components can be inserted on printed circuit board **60** in an
16 automated fashion (automatic insertion manufacturing typical
17 to the electronics industry) or by manual methods.
18 Alternatively, the closed circuit can be implemented by
19 soldering the components together directly, without the use of
20 the printed circuit board **60**, and subsequently securing, and
21 containing, the components in central opening **75** by an
22 encapsulating potting compound, e.g., EPOCAP 14530A/2404B,
23 available from Sanford Distributing Co., or a flexible

1 adhesive, such as silicone rubber, e.g., Silastic® silicone
2 rubber, available from Dow Corning.

3

4 In reading container label 32 and inspecting medicinal
5 product 30 contained within container receptacle 28, in
6 accordance with the present invention using container cap 22
7 illustrated in FIGS. 1 through 9, the individual initially
8 retrieves medicine container 20 from the appropriate location
9 (medicine cabinet, medicine drawer, bedside drawer, etc.).

10 Once in hand, the individual holds medicine container 20 in
11 such a way that at least one digit of his hand, preferably his
12 forefinger, rests on flexible membrane 46. While reading
13 container label 32, the individual presses flexible membrane
14 46 thus contacting cylindrical adaptor 80, which in turn
15 contacts electrical switch 52. As switch 52 closes, an
16 electrical current 58 flows from energy source 56 through
17 electrical current-limiting device 48, and illumination source
18 40, and eventually back to energy source 56. As electrical
19 current 58 flows through illumination source 40, illumination
20 source 40 is energized and lightwave 76 is emitted. Electrical
21 current-limiting device 48 can be adjusted to vary the
22 intensity of lightwave 76. Since illumination source 40 is a

1 wide-angle LED, light will emerge in a 360-degree, radial
2 direction toward the lightwave entry end **67** and into light
3 pipe channel **72**. Lightwave **76** is directed by light pipe
4 channel **72** through container cap **22** toward lightwave exit end
5 **68**. Lightwave **76** then travels through annular filter cover **62**
6 to become light beams **36**, which in turn illuminate container
7 label **32**. The individual may then read container label **32**.
8 On some medicine containers **20**, there is also instructional
9 text on the back of the container. For this case, the
10 individual simply rotates medicine container **20** and performs
11 the preferably identical procedure described above.
12 Additionally, the individual may use container cap **22** to
13 illuminate medicinal product **30**. This can serve as an
14 additional check that the individual is consuming the correct
15 medicine. The individual would perform this function by
16 removing container cap **22** from container receptacle **28**,
17 retrieving medicinal product **30**, placing it in his palm,
18 between his fingers, or on a tabletop, and then using
19 container cap **22** as described above, while removed from
20 container receptacle **28** or attached thereto, to illuminate
21 medicinal product **30**.

22

1 FIGS. 10 through 15 illustrate a second embodiment of a
2 medicine container, generally 100, embodying a container cap,
3 generally 102. Medicine container 100 also includes a
4 container receptacle 28 and a container label 32, both
5 preferably identical to those described in detail above.

6

7 Container cap 102 is comprised of an annular supporting
8 structure 144 having a cavity 148 into which is fitted a
9 printed circuit board 120. Thus, printed circuit board 120 is
10 contained within container cap 102 and is preferably
11 positioned perpendicular to the longitudinal axis of attached
12 container receptacle 28. Printed circuit board 120 is secured
13 in cavity 148 to annular supporting structure 144, preferably
14 by adhesive 61, such as AS-124M removable adhesive, available
15 from Adhesives Research, Inc., although other securing methods
16 may be used. Annular supporting structure 144 also contains an
17 annular receiving ledge 116 to accept container cap insert
18 cover 24. Container cap insert cover 24 is connected to
19 annular supporting structure 144 at annular receiving ledge
20 116 either by a frictional fit or by an adhesive, e.g.,
21 silicone rubber. Container cap insert cover 24 also contains
22 flexible membrane 46, preferably identical to that described

1 in detail above, which makes direct contact with electrical
2 switch 52, e.g., a Panasonic EVQ-PLDA15. Container cap 102
3 also contains a plurality of annularly arranged openings 108
4 from which a plurality of lightwaves 104 emerge. The
5 lightwaves 104 are generated by a plurality of illuminating
6 sources 128, e.g., a blue light emitting diode, such as a
7 Lumex SSL-LX3044USBC, although other LEDs, emitting other
8 colors, or incandescent bulbs, such as a Copeland retinoscope
9 lamp bulb, may be used. Annular supporting structure 144 is
10 preferably fabricated by molding an opaque plastic material,
11 such as colored Acrylic or colored Lexan. Additionally,
12 annular supporting structure 144 can be machined from plastic
13 stock (e.g., cast Acrylic rod).

14

15 Lightwaves 104 travel through a plurality of filter covers
16 110 to create a plurality of light source beams 106, which
17 illuminate container label 32. Similar to the preferred
18 embodiment discussed above, filter covers 110 may be
19 manufactured with different colors depending on the color of
20 the LED used. For example, filter covers 110 can be made from
21 a blue-colored material to produce a bluish illumination if
22 illuminating source 128 is a white LED. In fact, there are a
23 wide variety of LED/filter combinations that can be used to

1 create many light beams colors. Further, colored LED lens
2 covers, e.g., a Chicago Miniature Lamp 434-6, can be used,
3 which snap directly onto the LED itself, thus offering yet
4 another method for achieving various illumination colors.
5 Thus, there are a number of possibilities for creating various
6 illumination colors. Filter covers 110 also provide
7 environmental protection, e.g., waterproofing, for the
8 internal components of container cap 102. Annular supporting
9 structure 144 has a set of internal threads 64 for attachment
10 to a set of external threads 66 in container receptacle 28.

11

12 Printed circuit board 120 contains energy source 56, e.g.,
13 a Duracell D361, a variable current-limiting device 112, e.g.,
14 a Bourns Series 3309P, a plurality of illuminating sources
15 128, connected by a plurality of illuminating source leads
16 124, and electrical switch 52, all connected by PCB circuit
17 traces in order to implement the closed circuit shown in FIG.
18 15. In the second embodiment four illuminating sources 128 are
19 used, however, more or less illuminating sources 128 could be
20 used to generate lightwaves 104. These circuit components can
21 be inserted on printed circuit board 120 in an automated
22 fashion (automatic insertion manufacturing typical to the
23 electronics industry) or by manual methods. Alternatively,

1 the closed circuit can be implemented by soldering the
2 components together directly, without the use of printed
3 circuit board 120, and subsequently securing the components in
4 cavity 148 by an encapsulating potting compound, e.g., EPOCAP
5 14530A/2404B, available from Sanford Distributing Co., or a
6 flexible adhesive, such as silicone rubber, e.g., Silastic®
7 silicone rubber, available from Dow Corning.

8

9 The second embodiment of the invention shown in FIGS. 10
10 through 15 utilizes the same functional principles as those
11 described in the preferred embodiment above, but operates in a
12 slightly different manner. The individual holds medicine
13 container 100 in such a way that at least one digit of the
14 individual's hand, preferably the forefinger, rests on
15 flexible membrane 46. While reading container label 32, the
16 individual presses flexible membrane 46 thus directly
17 contacting electrical switch 52. As switch 52 closes, an
18 electrical current 152 flows from energy source 56 through
19 variable current-limiting device 112 and divides into a
20 plurality of smaller electrical currents 132. Each of smaller
21 electrical currents 132 flow through respective illuminating
22 sources 128, and eventually combine to return back to energy
23 source 56. As smaller electrical currents 132 flow through

1 each illuminating source **128**, each illuminating source **128** is
2 energized and lightwaves **104** are emitted and travel through
3 filter covers **110** to form light source beams **106**. Variable
4 current-limiting device **112** can be adjusted to vary the
5 intensity of lightwaves **104**. Light source beams **106** overlap in
6 such a way that container label **32** is illuminated in its
7 entirety. The individual may then read container label **32** in a
8 variety of ways as described above in the preferred
9 embodiment.

10

11 FIG. 16 illustrates a third embodiment of a medicine
12 container, generally **200**, embodying a container cap, generally
13 **204**. Medicine container **200** also includes a container
14 receptacle **28** and a container label **32**, both preferably
15 identical to those described in detail above. In this
16 embodiment electrical switch **52** has been moved to the side of
17 container cap **204** just beneath a side-mounted flexible
18 membrane material **212** attached to a container cap side **214**. A
19 container cap insert cover **208** is connected to container cap
20 **204** either by a frictional fit or by an adhesive, e.g.,
21 silicone rubber. Container cap **204** has internal structure,
22 similar to that described in detail above, in order to enclose

1 and support the appropriate printed circuit board and
2 components.

3

4 The third embodiment of the invention shown in FIG. 16
5 utilizes the same functional principles as above, but operates
6 in a slightly different manner. The individual holds medicine
7 container 200 in such a way that at least one digit of his
8 hand, preferably his thumb, rests on side-mounted flexible
9 membrane 212. While reading container label 32, the individual
10 presses flexible membrane 212 thus directly contacting
11 electrical switch 52 just beneath. As electrical switch 52
12 closes, electrical current flows from energy source 56 and
13 energizes the LEDs as described above (either the single LED
14 of the preferred embodiment or the plurality of LEDs of the
15 second embodiment). The individual may then read container
16 label 32 or inspect medicinal product 30 in a variety of ways
17 as described above in the preferred embodiment.

18

19 FIG. 17 illustrates a fourth embodiment of the invention,
20 which provides a different method for activating the switch
21 mechanism. In this embodiment a flexible container cap insert
22 cover 216, preferably constructed entirely from a thin plastic
23 or rubber material, is used to make contact with electrical

1 switch 52 either directly, or indirectly through cylindrical
2 adaptor 80. Flexible container cap insert cover 216 is
3 connected to outer annular support rim 70 in the preferred
4 embodiment, or to annular supporting structure 144 in the
5 second embodiment, by a frictional fit (or by an adhesive,
6 e.g., silicone rubber or AS-124M removable adhesive, available
7 from Adhesives Research, Inc.).

8

9 In the fourth embodiment shown in FIG. 17 the individual
10 holds medicine container 20 in such a way that at least one
11 digit of his hand, preferably his forefinger, rests on
12 flexible container cap insert cover 216. While reading
13 container label 32, the individual presses flexible container
14 cap insert cover 216 thus contacting cylindrical adaptor 80,
15 which in turn contacts electrical switch 52 (FIG. 2), or by
16 directly contacting the switch when cap insert cover 216 is
17 used in the second embodiment shown in FIG. 11. The individual
18 may then read container label 32 or inspect medicinal product
19 30 in a variety of ways as described above in the preferred
20 embodiment.

21

22 FIG. 18 illustrates a fifth embodiment of the invention
23 whereby illumination source 40 is energized using a monostable

1 multivibrator 310, e.g., a National Semiconductor LMC555CM,
2 although other timer circuitry may be implemented. In this
3 mode, a monostable pulse output 314, in the ON state,
4 energizes illumination source 40. Illumination source 40
5 remains energized for a preset period of time, T, generally
6 318, thus ensuring that the LED is de-energized after a
7 certain amount of time, further conserving energy source
8 lifetime. Monostable multivibrator 310, illumination source
9 40, energy source 56, and electrical switch 52 can all be
10 mounted on a printed circuit board similar to that described
11 in the preferred embodiment above. Monostable multivibrator
12 310 can also energize illuminating sources 128 if used in the
13 second embodiment described above.

14
15 The fifth embodiment shown in FIG. 18 operates to conserve
16 the energy contained in energy source 56, thus prolonging its
17 lifetime. The multivibrator circuit shown operates in a
18 monostable, or "one-shot," mode. When switch 52 is pressed
19 then released, monostable multivibrator 310 outputs a preset
20 timed pulse just long enough for the individual to read
21 container label 32, e.g., 15-20 seconds, although other times
22 may be programmed. Monostable pulse output 314 energizes
23 illumination source 40 for preset period of time, T 318.

1 Energized illumination source 40 in turn illuminates container
2 label 32 as described above. Once preset period of time, T
3 318 is complete, monostable pulse output 314 de-energizes
4 illumination source 40 thus stopping a monostable pulse output
5 electrical current flow 322 and conserving energy source 56.
6 The individual may energize illumination source 40 again by
7 pressing then releasing switch 52. This approach may also
8 function with the second embodiment shown in FIGS. 10-15,
9 whereby all four illuminating sources 128 would be energized
10 by monostable pulse output 314.

11

12 As described in FIG. 19, in a sixth embodiment, an astable
13 multivibrator circuit 300, e.g., a National Semiconductor
14 LMC555CM, although other timer circuitry may be implemented,
15 can be used to energize illumination source 40 by turning it
16 ON and OFF very rapidly. This has the dual effect of reducing
17 the current illumination source 40 draws while energized, thus
18 prolonging energy source 56 lifetime, while also changing the
19 brightness of illumination source 40 by varying the voltage
20 supplied to illumination source 40. Both of these features are
21 accomplished by changing the duty cycle [T(on) / T(off)] of
22 periodic pulse train, generally 304, output from astable

1 multivibrator circuit 300. The maximum brightness, and maximum
2 electrical current drain from energy source 56, occur when
3 $T(\text{on}) = T(\text{off})$. Brightness and electrical current drain
4 decrease as $T(\text{on})$ decreases and $T(\text{off})$ increases. Illumination
5 will appear to be "ON" to the patient, e.g., not visibly
6 flickering, as long as the frequency of the pulse train
7 remains above approximately 60-Hz. Astable multivibrator
8 circuit 300, illumination source 40, energy source 56, and
9 electrical switch 52 can all be mounted on a printed circuit
10 board similar to that described in the preferred embodiment
11 above. Astable multivibrator circuit 300 can also energize
12 illuminating sources 128 if used in the second embodiment
13 described above.

14

15 The sixth embodiment shown in FIG. 19 operates to further
16 conserve the energy contained in energy source 56, thus
17 prolonging its lifetime. The multivibrator circuit shown
18 operates in an astable mode, or "free-running" mode. When
19 switch 52 is pressed and held closed, astable multivibrator
20 circuit 300 outputs preset periodic pulse train 304. Periodic
21 pulse train 304 presents a high state [$T(\text{off})$] and a low state
22 [$T(\text{on})$] as shown in FIG. 19. In this embodiment, a low state
23 energizes illumination source 40 while a high state de-

1 energizes illumination source **40**. In such a configuration, the
2 average voltage delivered to illumination source **40** depends on
3 the duty cycle, with no power dissipation during the OFF
4 periods [$T(\text{off})$] (e.g., no energy source electrical current
5 drain). Astable multivibrator circuit **300** can be used to
6 deliver a duty cycle from 50% to 99%. By using the LOW period
7 [$T(\text{on})$] of periodic pulse train **304** to power illumination
8 source **40**, and setting a 50% duty cycle [$T(\text{on}) = T(\text{off})$] as
9 the maximum brightness (and maximum energy source electrical
10 current drain), one can control the illumination source **40**
11 brightness and electrical current drain from virtually OFF
12 (99% duty cycle) to a maximum ON (50% duty cycle). Periodic
13 pulse train **304** of astable multivibrator circuit **300** energizes
14 illumination source **40** with an astable output electrical
15 current flow **326**, which in turn illuminates container label **32**
16 as described before. This approach may also function with the
17 second embodiment shown in FIGS. 10-15, whereby periodic pulse
18 train **304** would energize all four illuminating sources **128**.

19
20 FIG. 20 illustrates a seventh embodiment which combines
21 monostable multivibrator **310** with astable multivibrator
22 circuit **300**. In this case a dual-timer integrated circuit,
23 such as a National Semiconductor LM556CMXTR, may be used,

1 although other timer circuitry may be implemented. Monostable
2 multivibrator **310**, astable multivibrator circuit **300**,
3 illumination source **40**, energy source **56**, and electrical
4 switch **52** can all be mounted on a printed circuit board
5 similar to that described in the preferred embodiment above.
6 Monostable multivibrator **310** and astable multivibrator circuit
7 **300** can also energize illuminating sources **128** if used in the
8 second embodiment described above.

9

10 The seventh embodiment shown in FIG. 20 operates to
11 further conserve the energy contained in energy source **56**,
12 thus prolonging its lifetime even further. When switch **52** is
13 pressed then released, monostable multivibrator **310** outputs a
14 preset timed pulse just long enough for the individual to read
15 the container label **32**, e.g., 15-20 seconds, although other
16 times may be programmed. In this embodiment monostable pulse
17 output **314** is used to activate astable multivibrator circuit
18 **300**, which in turn energizes illumination source **40** with
19 periodic pulse train **304** as described above. Energized
20 illumination source **40** in turn illuminates container label **32**
21 as described before. Illumination source **40** is energized for
22 preset period of time, T **318**. Once preset period of time, T

1 **318** is complete, monostable pulse output **314** de-activates
2 astable multivibrator circuit **300** thus stopping astable output
3 electrical current flow **326** and conserving energy source **56**.
4 The individual may energize illumination source **40** again by
5 pressing then releasing switch **52**. This approach may also
6 function with the second embodiment shown in FIGS. 10-15,
7 whereby periodic pulse train **304** would energize all four
8 illuminating sources **128**.

9

10 FIGS. 21 and 22 illustrate an eighth embodiment of the
11 invention using a medicine container, generally **400**, embodying
12 a container cap, generally **404**, a conventional container cap
13 **408**, and container label **32** attached to container receptacle
14 **28**, both preferably identical to those described in detail
15 above. In this embodiment container cap **404** is removably
16 coupled to conventional container cap **408**. Container cap **404**
17 is similar to container caps **22**, **102**, **204** described above with
18 respect to illumination and control of illumination, but the
19 structure used for attachment to container receptacle **28** is
20 adapted to allow container caps **22**, **102**, **204** to attach
21 directly to conventional container caps **408**, which are
22 currently supplied with medicine containers. That is,

1 container cap 404 is removably connected to conventional
2 container cap 408 at junction 416 by a frictional fit or by an
3 adhesive, e.g., silicone rubber or AS-124M removable adhesive,
4 available from Adhesives Research, Inc.

5

6 The eighth embodiment of the invention shown in FIGS. 21
7 and 22 utilizes the same principle as above, but operates in a
8 slightly different manner. In reading container label 32 and
9 inspecting medicinal product 30 contained within container
10 receptacle 28, the individual retrieves medicine container 400
11 and then attaches container cap 404 directly to conventional
12 container cap 408. The individual does so by initially
13 aligning container cap 404 to conventional container cap 408,
14 as shown in FIG 22, and then pushing container cap 404 until
15 it is firmly seated on conventional container cap 408, as
16 shown in FIG. 21. The individual may then read container label
17 32 or inspect medicinal product 30 using light source beams,
18 generally 412, in a variety of ways as preferably described in
19 the above embodiments.

20

21 FIGS. 23 and 24 illustrate a ninth embodiment of the
22 invention using a medicine container, generally 500, embodying
23 an illumination base, generally 502, and container label 32

1 attached to container receptacle 28, both preferably identical
2 to those described in detail above. In this embodiment
3 medicine container 500 is removably coupled to illumination
4 base 502. Illumination base 502 is larger than medicine
5 container 500 and serves as a supporting base to hold medicine
6 container 500 when medicine container 500 is inserted into an
7 opening 506, which contains a plurality of friction fingers
8 504 configured radially within illumination base 502. Friction
9 fingers 504 are formed from a moldable flexible material, such
10 as silicone rubber, and serve to press against medicine
11 container 500 (see Fig. 24B) therefore holding it in place
12 when medicine container 500 is placed in illumination base
13 502. Illumination of container label 32 occurs when a
14 plurality of light source beams 512 are emitted from an
15 annular output opening 508. Light source beams 512 are
16 generated as described above using either a single LED 522
17 with a light pipe channel 518, preferably made from acrylic as
18 described above, or with a plurality of LEDs (not shown)
19 directed from illumination base 502 toward container label 32.
20 Additionally, other light sources could be used to generate
21 light source beams 512.

22

1 The ninth embodiment of the invention shown in FIGS. 23
2 and 24 utilizes the same principle as above, but operates in a
3 slightly different manner. In reading container label 32 and
4 inspecting medicinal product 30 contained within container
5 receptacle 28, the individual retrieves medicine container 500
6 and then inserts it in opening 506 in illumination base 502
7 through friction fingers 504. As medicine container 500
8 contacts an electrical switch 516 within the base 502, just
9 under friction fingers 504, LED 522 is energized and emits
10 light source beams 512, which travel through light pipe
11 channel 518 where they are directed to label 32. The
12 individual may then read container label 32 or inspect
13 medicinal product 30 using light source beams 512.

14

15 FIGS. 25 and 26 illustrate a tenth embodiment of the
16 invention using a medicine container, generally 600, embodying
17 an illumination base, generally 602, and container label 32
18 attached to container receptacle 28, both preferably identical
19 to those described in detail above. In this embodiment
20 medicine container 600 is removably coupled to illumination
21 base 602. Illumination base 602 further consists of a
22 supporting base 620 and an enclosing container illumination

1 lightpipe **616**, which is larger than medicine container **600** and
2 aligns with an output aperture **608**. Lightpipe **616** is
3 preferably circular and made from acrylic, as described in the
4 above embodiments. Lightpipe **616** could also be constructed in
5 another shape, such as rectangular or square, as long as
6 output opening **608** is of a similar configuration. Supporting
7 base **620** serves as a supporting base to hold medicine
8 container **600** when medicine container **600** is inserted into an
9 opening **606**, which contains a plurality of friction fingers
10 **604**. Friction fingers **604** are formed from a flexible material,
11 such as silicone rubber, and serve to press against medicine
12 container **600** therefore holding it in place when medicine
13 container **600** is placed in supporting base **620**. Illumination
14 of container label **32** occurs when a plurality of light source
15 beams **612** are emitted from an annular output opening **608** and
16 travel through lightpipe **616** to label **32**. Light source beams
17 **612** are generated as described above using either a single LED
18 with a light pipe channel (not shown), or with a plurality of
19 LEDs (not shown) directed from supporting base **620** toward
20 container label **32**. Additionally, other light sources could be
21 used to generate light source beams **612**.

22

1 The tenth embodiment of the invention shown in FIGS. 25
2 and 26 utilizes the same principle as above, but operates in a
3 slightly different manner. In reading container label 32 and
4 inspecting medicinal product 30 contained within container
5 receptacle 28, the individual retrieves medicine container 600
6 and then inserts it in enclosing container illumination
7 lightpipe 616 until it engages friction fingers 604 within
8 opening 606. As medicine container 600 contacts an electrical
9 switch 516 (not shown) within the base 620, just under
10 friction fingers 604, the LED is energized and emits light
11 source beams 612, which travel through light pipe channel 616
12 where they are directed to label 32. The individual may then
13 read container label 32 or inspect medicinal product 30 using
14 light source beams 612.

15

16 There have been described and illustrated herein
17 embodiments of a self-contained illumination cap for medicine
18 containers and methods for using the same. While particular
19 embodiments of the invention have been described, it is not
20 intended that the invention be limited thereto, as it is
21 intended that the invention be as broad in scope as the art
22 will allow and that the specification be read likewise. Thus,
23 it is recognized that although the container cap is shown

1 connected to the medicine container receptacle by threads,
2 thus signifying a typical, adult-type cap, with a screw-on,
3 screw-off action, other types of connections will work as
4 well. In particular, the container cap can be designed as a
5 childproof or child resistant cap, e.g., those types that have
6 to be further manipulated in some fashion before being
7 removed; as an adult cap that simply snaps off or pulls off of
8 the medicine container receptacle; or as a universal cap
9 (e.g., such as one using o-rings to provide a frictional fit)
10 that fits a wide variety of containers and/or conventional
11 container caps. In other words, there are a number of
12 attachment methods that may be implemented.

13

14 It is also recognized that although the light beams are
15 created by an LED, other illumination sources may be used as
16 well, such as incandescent bulbs, electroluminescent sources,
17 or fluorescent sources, to name a few. Additionally, although
18 the preferred embodiment shows only one LED centered in the
19 container cap, more than one LED could be used to provide
20 lightwaves to the light pipe channel. Also, although the
21 second embodiment shows multiple LEDs used to illuminate the
22 label (four LEDs shown) in a complete 360-degree range, the
23 device can function with as few as one LED, that is, such

1 illumination can be less dispersed. In this case, the
2 container cap can be rotated through 360-degrees to read a
3 label that completely encompasses the container.

4

5 It is further recognized that although the preferred
6 embodiments describe a current-limiting device, such as a
7 resistor or potentiometer, to limit electrical current
8 delivered from the energy source to the illumination source,
9 other illumination sources with built-in current limiting
10 capabilities may be used, thus negating the use for a discrete
11 current-limiting device (e.g., such as an LED with an internal
12 resistor). Additionally, the energy source and illumination
13 source may be chosen in such a way that there is no need for a
14 current-limiting device (e.g., the battery voltage is just
15 enough to supply the voltage required by the illumination
16 source).

17

18 It is even further recognized that although the preferred
19 embodiment describes a light guide constructed using the
20 material inherent to the cap, other types of light delivery
21 devices may be used as well, such as individual optical fibers
22 or individual light pipes (e.g., acrylic plastic or liquid)
23 designed to fit within the container cap. Additionally,

1 although the light pipe channel of the preferred embodiment is
2 shown with a flat entry surface, a curved entry surface can be
3 constructed which acts to gather more light from the
4 illumination source into the light pipe channel. Even further,
5 a curved exit surface can be constructed which acts to focus
6 more of the light to the label. Additionally, even though the
7 annular filter cover is shown with a flat surface, a curved
8 exit surface can be constructed which acts to focus more of
9 the light to the label.

10

11 It is also understood that although the energy source is
12 shown as a silver-oxide button cell, other battery-type energy
13 sources may be used as well, such as mercury-oxide cells,
14 lithium cells, lithium manganese dioxide, or zinc-air cells, to
15 name a few. It is also conceivable that other sources of
16 energy may be used to energize the LED. These include solar
17 cells with some type of energy storage medium (such as a
18 capacitor), fuel cells, or magneto-electric whereby energy is
19 generated by motion and stored in some type of energy storage
20 medium (e.g., a capacitor).

21

22 It is further understood that although the switch
23 presented above to energize the illumination source is a

1 manufactured, packaged switch, discrete switches made from
2 individual parts (such as separate metal spring strips
3 attached to the printed circuit boards) could be used as well.
4 Additionally, although metal contact switches are presented,
5 other switching mechanisms, such as liquid mercury tilt
6 switches could be used. Further, although the switch is shown
7 directly beneath the LED in the above embodiments, it could be
8 placed in another location on the PCB. Even further, the
9 switch mechanism could be placed within the outer walls of the
10 cap, such that the patient could squeeze the cap anywhere
11 along its sides to energize the illumination sources (e.g., a
12 pair of metal strips can be designed within a flexible cap
13 wall such that when the wall is squeezed, an outside circular
14 metal strip would contact an inner circular metal switch thus
15 connecting the energy source to the illumination source). That
16 is, there are a number of possible construction methods and
17 locations of devices that can be used to energize the
18 illumination sources.

19
20 It is even further recognized that there are additional
21 circuits, both discrete and integrated (ICs), that can perform
22 equivalently to the monostable and astable multivibrator
23 functions, that is, to conserve energy source lifetime and

1 control LED brightness. Additionally, although surface mount
2 components are described in the above embodiments, it is noted
3 that more traditional, non-surface mount devices may be used
4 as well.

5

6 It is even further understood, that although the current
7 embodiments are shown with a flat flexible membrane, a raised
8 or curved membrane could also be used. Additionally, although
9 shown with a smooth surface, the top surface of the flexible
10 membrane can also be manufactured with texture, such as raised
11 lines or a raised cross-hatched pattern, providing further
12 ease in using the device in low-light conditions.

13

14 It is additionally recognized that although the
15 illumination base of the ninth and tenth embodiments is shown
16 with a square shape, other shapes, such as circular, oval,
17 rectangular, hexagonal, etc. could be utilized as well. Even
18 further, although the opening that accepts the medicine
19 container is shown as being circular, it could also be of a
20 variety of shapes, such as oval, square, rectangular,
21 hexagonal, etc. That is, there are a number of variations for
22 the base construction with respect to its shape and opening.
23 Additionally, although radial friction fingers, which hold the

1 medicine container in the base, are shown, other
2 configurations of friction fingers could be used, such as a
3 plurality of fingers arranged in a parallel fashion to each
4 other. It is also recognized that although only one opening
5 is shown in the illumination base, there could be a plurality
6 of openings with accompanying illumination means for each,
7 such that a number of containers could be viewed
8 simultaneously. Further, although an internal electrical
9 switch is shown and used to energize the illumination sources,
10 it is recognized that an external switch, mounted on the top
11 surface or side surface of the illumination base, may also be
12 used to energize the illumination sources. Even further,
13 although an electrical switch is shown, it is recognized that
14 an electro-optical switch mechanism could be implemented such
15 that when the container is inserted in one of the illumination
16 base openings, the container body interacts with the electro-
17 optical switch such that the illumination sources are
18 energized.

19

20 It will also be appreciated by those skilled in the art
21 that yet other modifications could be made to the provided
22 invention without deviating from its spirit and scope as
23 claimed. As such, those skilled in the art will appreciate

1 that the conception, upon which this disclosure is based, may
2 readily be utilized as a basis for the designing of other
3 structures, methods and systems carrying out the several
4 purposes of the present invention. It is important,
5 therefore, that the claims be regarded as including such
6 equivalent construction insofar as they do not depart from the
7 spirit and scope of the present invention.

8